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# SCIENCE TRENDS

HIGHLIGHTS

- \* Air Force Weapon Systems
- \* Missile Defense?
- \* Project Plowshare
- \* Research Checklist
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## Air Force Weapon Systems

- \* Future Space Weapon Systems: Here is an official catalog of the major space weapon systems which the Air Force now considers "necessary" for future military space operations. These projects are in various phases of study and exploration:

- O Offensive Weapons: Advanced Strategic Missile Systems  
Manned Strategic Space Systems
- O Defensive Weapons: Anti-Missile Defense System (Early Warning and Extensions)  
Satellite Defense System  
Satellite Inspection System  
Manned Defensive Space System
- O Reconnaissance: Reconnaissance Satellite Weapon System, and Infrared Subsystem (Alert System)  
Visual Reconnaissance Subsystem  
Mapping and Charting Subsystem
- O Supporting Systems: Communications Satellite  
Environmental Observing and Forecasting System  
Space Navigation System  
Specialized Test Vehicle  
Integrated Ground Acquisition and Tracking System  
Logistic Support Systems  
Recoverable Boosters (Prime Movers)  
Maintenance and Resupply  
Space Transportation System

- \* What is A Weapon System? Air Force is disturbed because of what it calls "considerable misunderstanding" over the term and concept "weapon system." Here is the new official definition:

"A combat instrument composed of hardware, people and services. The complete weapon system includes a major operational element - usually, but not necessarily an aerospace vehicle -- and all the related equipment, materials, personnel, skills and techniques needed solely to operate the major element, so that the entire system becomes a self sufficient unit of striking power in its intended operational environment."

## Transportation of Liquified Gases

National Bureau of Standards finds that liquified helium, nitrogen and hydrogen gases can be economically transported over long distances through special techniques in storage, handling and transfer. The system brings liquified gases within the reach of research groups previously hindered from undertaking low-temperature projects because they lacked immediate access to liquefaction facilities.

- \* Procurement -- Liquified gases are procured for the Bureau's own Free radical research program. Liquid helium produced at the Bureau's Boulder, Colo., laboratories is flown between Denver and Washington, eliminating difficulties such as Dewar damage, vibration and sloshing which arise in trunk or rail transportation over long distances. Losses for each 50 liter Dewar during the flight amount to only 1 or 2 liters. Liquid hydrogen, procured commercially, is shipped without nitrogen shielding in special pressurized Dewars so that it can be stored if immediate transfer is not convenient. The hydrogen is shipped some 500 miles by a specially grounded truck in 100-liter quantities. Loss rate during shipment is about 3 liters per day. Liquid nitrogen, from commercial sources is delivered directly to requisitioners in individual 50 liter containers to eliminate extra handling.
- \* Storage -- Nitrogen and helium supplies are housed in a central-storage area between the time of procurement and delivery to individual laboratories. Liquid nitrogen to be used for liquefaction of helium is stored in 300 gal. quantities, with a loss of 3 to 4 liters per day. The 50-liter commercial-type containers for nitrogen delivered to requisitioners has a loss rate of approximately 1 to 1.5 liters daily. Both helium and hydrogen are stored in 50-liter nitrogen-shielded commercially manufactured Dewars. Losses over a 24 hour period are said to be 0.1 to 0.4 liter for hydrogen and 0.3 to 0.8 liter for helium. The Bureau arranged to have the dimensions of these storage containers carefully controlled in manufacture to allow siphoning equipment to be used most efficiently in all transfer operations.
- \* Transfer -- A double transfer method is used to transport the heavy liquified gases and containers. Liquid is first transferred from the storage Dewar to a transport Dewar, and from the transport Dewar to the experimental apparatus, with a loss of about 250 cc. A Bureau-designed vacuum-insulated transfer siphon is used because of the low heat of vaporization. The actual transport vessels are well-taped strip silvered Pyrex Dewars, ranging in capacity from 2 to 3 liters. More than 2400 transfers have been made to date without Dewar loss or injury.

## Bio-Astronautics

Executive Council of the new Armed Forces - National Research Council Committee on Bio-Astronautics plans to meet at Woods Hole, Mass. late this month to detail plans for future action in a number of related fields.

Industrial, Governmental and University members have been selected for panels on Information, Extra-Terrestrial Life, Closed Ecological Systems, Bio-Instrumentation, Acceleration Stress, Biological Orientation and Navigation, Psychology, Radiation Biology, Bio-Engineering of Protective Systems, and Identification of Long-Range Problems.

(Details on Missions and Membership of Bio-Astronautics Panels available on request. Write Service Department, 1120 National Press Building, Washington 4, D.C.)

## Nuclear Notebook

### \* Missile Defense?

A Soviet report circulated by a U.S. Government Agency this week raises speculation that nuclear warheads may be destroyed by the neutron clouds which follow high-altitude nuclear explosions.

Prof. F. Rubkin, writing in a Soviet Naval Journal, declares that "if a flying device with an atomic motor or an atomic charge falls into such a neutron cloud, then the uranium 235 or plutonium they contain will be intensely heated. An atomic explosion will not occur under these circumstances. However, strong heating can lead to the melting of the uranium 235 or the plutonium and to the destruction of the atomic motor or charge."

### \* Project Plowshare

A new parallel route to the Panama Canal is again under study by Government officials. Proposals include the use of controlled nuclear explosions for excavation purposes. AEC Chairman John McCone has considered a laboratory estimate which indicates that a second canal could be built at a saving of \$2 billion if nuclear rather than conventional explosives are used. Such a "saving" would be about four times the entire cost of the original canal, when it was built.

### \* Stanford Accelerator

Construction of a \$105 million high energy electron linear accelerator at Stanford University, Palo Alto, Calif., is expected to receive approval by Congress this year, although many influential Democrats are annoyed at the way the matter was handled by the Eisenhower Administration.

Politics aside, members of the Joint Committee on Atomic Energy are obviously intrigued by the many possibilities inherent in operation of such a huge device. Leland J. Haworth, Brookhaven National Laboratory, raises what may be the most important application -- the study of electromagnetic interaction.

"It is quite possible," he believes, "that at the very short distances involved the laws of quantum electrodynamics may be altered or even fail completely. Indeed, the results of such experiments could raise questions of great philosophic and scientific interest. Under certain circumstances, the question might be raised of a radical revision of our concept of space itself. At sufficiently short distances do the axioms of Euclidean geometry fail? Can even the notion of continuity of space be maintained? Even should such conceivable anomalies not be found, information on these points would be most valuable. ...."

### \* New Radioisotope Laboratory

Atomic Energy Commission plans to build a new \$1.5 million radioisotope process development laboratory, probably at Oak Ridge, for advanced R&D studies on the application of radioisotopes and the fabrication of radiation sources.

Commission stresses that it "normally" does not engage in direct competition with private business in the development and routine production of radioisotope utilization devices. It explains that such work, when done in private laboratories is usually "company confidential" and directed toward specific products. The new AEC lab will concentrate on "pioneering" research.



### RESEARCH CHECKLIST

- ( ) Gasoline and Oil Fires: Chemists at the Naval Research Laboratory describe as "revolutionary" a "Purple K Powder" which can reportedly extinguish gasoline and oil fire twice as fast as materials available currently. The new agent, now in the process of commercialization, consists of dense-potassium bicarbonate. The powder is inexpensive, non-toxic and can be used in conventional fire extinguishers.
- ( ) Experimental Data: A new method for the fitting of straight lines to cumulative experimental data has been devised at the National Bureau of Standards. A criterion for judging whether plotted data are cumulative or independent has also been developed and has been applied to a study of the relation between mechanical stress and double refraction in optical glasses. The technique may also be applied to the study of rates of chemical reactions, or other investigations.
- (Details available. Free. Write Office of Technical Information, National Bureau of Standards, Washington 25, D.C.)
- ( ) Steel "Wedge Beams": Studies sponsored by the Navy have produced a practical method for predicting load-carrying capacities of tapered, cantilever steel beams -- "wedge beams," which have considerable material-saving possibilities. The study indicated that it was possible, by correct choice and location of tapers, to design "wedge beams" capable of safely handling the same work load as conventional, tapered units.
- (R&D by Civil Engineering Department, Columbia University, New York, 27, N.Y.)
- ( ) Metal Inspection Methods: Studies at the U.S. Army Watertown Arsenal indicate that control of electrochemical potential of crystalline metals can yield industrial and scientific information about the structure and character of materials. The technique may be applied to production-line inspection and quality controls.
- (Abstract available. Free. Write Service Department, Washington SCIENCE TRENDS, 1120 National Press Building, Washington 4, D.C.)
- ( ) Nuclear Rocket Study: The National Aeronautics and Space Administration has investigated the effects of turbopump design on a theoretical single-stage, hydrogen-propelled nuclear satellite vehicle. Among other things, it was found that large numbers of turbine stages would be required to minimize turbine flow rate and rocket gross weight. A twin-turbine drive system was found to be undesirable for all of the pump types investigated.
- (Report available. 37 pages. Free. Write Technical Information, NASA, 1520 H Street, N.W. for NASA Memo 5-12-59E)

- ( ) Electronic Microminiaturization: Office of Naval Research will sponsor studies at the Stanford Research Institute which may lead to effective micro-transistors and possibly "millions of components per square inch." The technique involves the use of a conducting film deposited on a clean, smooth surface. Film is exposed simultaneously to a low pressure decomposable gas and a sharply focused electron beam. After etching, the thin-layer "resist" is removed, leaving a microminiature printed circuit. Resolutions better than 100 angstroms (one millionth of a centimeter) are reported to have been achieved.

- ( ) Plastic Foams: U.S. Agricultural Research Service believes that there will be a "substantial" future market for domestic castor beans as the result of studies demonstrating that plastic or urethane foams having a wide range of properties can be made with castor oil as the major ingredient. High oil content foams have textures similar to soft foam rubber. Others are said to be especially promising for automobile dashboard crash pads and similar purposes.

(For further details Write Service Department, Washington SCIENCE TRENDS, 1120 National Press Building, Washington 4, D.C.)

- ( ) Subterranean Rocket: A translation prepared by the Central Intelligence Agency provides some details on a reported Soviet rocket used to construct subterranean pipelines. The device consists of a cylinder resembling an artillery shell, the head of which has a burner or jet to which liquid fuel and air are conducted. The system is secured to a tractor by cable. Underground, the hot flame from the burner is said to "fuse" the soil, leaving a large cylindrical opening suitable for use as a water conduit capable of serving for "tens of years." The device is said to be useful in irrigation projects.

- ( ) Mine Detection Research: Experimental research by the Army indicates the need for further development on detection equipment for non-metallic land mines. It has been concluded that in order to operate under varied soil conditions a system operating at several discrete frequencies in the range from about 10 cm to 300 cm will be required. An ellipsoidal antenna has been designed for use in the experimental program.

(R&D by U.S. Army Engineer Research and Development Laboratories, Ft. Belvoir, Va.)

- ( ) Controlled Environment: A new National Science Foundation Grant to Colorado University will permit construction of a controlled environment unit consisting of eight small chambers opening into a light-tight passageway. The unit will permit studies of photoperiodism and other problems of plant research by providing controllable, pre-selected temperatures and duration and intensity of light with constant, high humidity.

(R&D by Dr. Frank B. Salisbury, Colorado State University Research Foundation, Fort Collins, Colorado)

### PUBLICATION CHECKLIST

- ( ) Human Tolerance to Accelerations: an excellent survey and summary of available information from a number of sources on suddenly applied accelerations which may be encountered by human occupants in space vehicles. 93 pages. Free. (Write NASA Technical Information, 1520 H Street, N.W., Washington 25, D.C. for NASA Memo 5-19-59E)
- ( ) Reactor Physics, a handbook designed to make available the accumulated physics experience of the Knolls Atomic Power Laboratory in its work on intermediate spectrum reactors. 50 pages. \$3. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Pub. No Y 3 At 7:2 R 11/18/958)
- ( ) Teaching with Radioisotopes: a new manual of laboratory experiments for High School students. 60 pages. 40 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Pub. No. Y 3 At 7:2 R 11/18/958)
- ( ) Radioactive Wastes, a report recommending procedures for the disposal of radioactive wastes from nuclear-powered ships. Free (Write Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington 25, D.C. for "Considerations on the Disposal of Radioactive Wastes from Nuclear-Powered Ships into the Marine Environment.")
- ( ) Psychopharmacology, a limited number of selected reference lists on research methods and specific psychopharmacological agents are available without charge. (Write Technical Information Unit, Psychopharmacology Service Center, National Institute of Mental Health, Bethesda 14, Md.)
- ( ) Atomic Shipbuilding, a transcript of testimony and statements to Congress on U.S. Programs for maritime nuclear propulsion. 81 pages. Single copies free. (Write Committee on Merchant Marine and Fisheries, U.S. House of Representatives, Washington 25, D.C. for Hearings - Atomic Shipbuilding Program)
- ( ) Scientific Manpower & Education, a transcript of testimony, statements and exhibits on U.S. vs. Soviet policies in the field of engineering and scientific training. 708 pages. Single copies free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D.C. for Hearings -- No. 18)
- ( ) AEC Report, the complete index to the Atomic Energy Commission's Twenty-fifth Semiannual Report to Congress covering the period July to December, 1958. Just published. 50 pages. Single copies free. (Write Joint Committee on Atomic Energy, F-88, The Capitol, Washington 25, D.C. for Index - Twenty-Fifth AEC Report)
- ( ) Aerodynamic Heating & Fatigue, a review by the National Bureau of Standards of the physical conditions under which future airplanes will operate. Includes an excellent list of references for further study. 30 pages. Single copies free. (Write Technical Information, NASA, 1520 H Street, N.W. for NASA Memo 6-4-59W)

